

Chapter 1 Patterns and Recursion

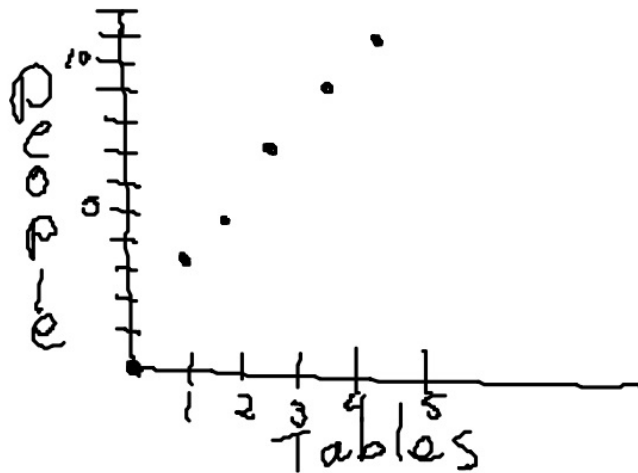
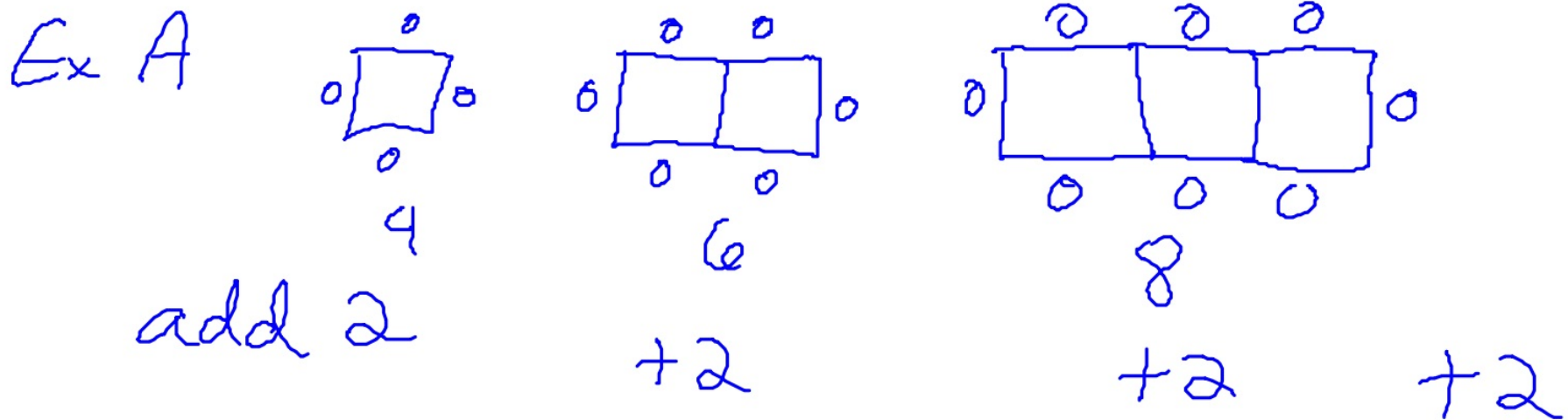
1.1 Recursively Defined Sequences

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Sequence — order things happen (1^{ST} , 2^{ND} , 3^{RD} , ...)

Recursively — follow the same steps again



add or subtract
the graph makes a
straight line
(do not connect)

4, 6, 8, 10

\mathbb{N}
 \mathbb{N}
 \mathbb{N}

Each item is called a "term".

first term u_1 "ewe sub one"

general term u_n

$$u_1 = 4$$

tables	1	2	3	4	5	$u_n = 2 + u_{n-1}$ where $n \geq 2$
people	4	6	8	10		

$$u_1 =$$

$$u_2, u_3$$

$$n >$$

$$u_0 =$$

$$u_1, u_2$$

$$n <$$

Ex B

Row	1	2	3	4	...	n
Seats	59	63	67	71	...	95

$$u_1 = 59$$

$$u_n = u_{n-1} + 4$$

$$\text{where } n \geq 2$$

+1

$$u_4 = u_3 + 4$$

$$u_4 = 67 + 4$$

$$u_4 = 71$$

$$u_n = 95$$

$$u_n = u_{n-1} + 4$$

$$\frac{36}{4} = 9 + 1 = u_{10}$$

$$83 - 71 = 12$$

$$95 - 59 = \text{seats gained} \quad u_n - u_4 = 3$$

$$36$$

$$U_1 = 59$$

$$U_n = U_{n-1} + 4$$

Where $n \geq 2$

Common
difference

Arithmetic Sequence

Recursive sequences which add (+) or subtract (-) only

$$U_n = U_{n-1} + d$$

Ex C

Stage	0	1	2	3	4
Triangles	1	3	9	27	81

$\xrightarrow{\times 3} \xrightarrow{\times 3} \xrightarrow{\times 3}$

$$U_0 = 1$$

$$U_n = 3 \cdot U_{n-1}$$

common
ratio

$$\begin{array}{r} 60 \\ + 21 \\ \hline 81 \end{array}$$

where $n \geq 1$

geometric sequence

recursive sequence using multiply
and divide (\div) only

$$U_n = r \cdot U_{n-1}$$

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#1-6

recursive formula

a) 2, 6, 10, 14

$$u_1 = 2$$

$$u_n = u_{n-1} + 4$$

Where $n \geq 2$

$$u_{15} = u_1 + (n-1)(d)$$

$$= 2 + 14(4)$$

$$= 2 + 56$$

$$u_{15} = 58$$

$$u_1 = 10$$

$$d = -5$$

$$u_{12} = 10 + (11)(-5)$$

$$= 10 - 55$$

$$u_{12} = -45$$

$0.4, 0.04, 0.004, 0.0004$

$$u_1 = 0.4$$

$$u_n = 0.1 u_{n-1}$$

where $n \geq 2$

$$u_{10} = 0.00000000004 \quad 4 \times 10^{-10}$$

arithmetic sequence

~~or~~ + $U_n = U_{n-1} + d$

geometric sequence

\div or \times $U_n = U_{n-1} \cdot r$

growth

increasing 

decay

decreasing 